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CONFIDENTIAL

Progress Rep

Contract No. RD[redacted] January 25, 1957 25X1

Task 1

1. Phase 1 co[redacted]RITY INFORMATION

2. Phases 2 and 3 cancelled. SECRET

Task 2

1. AC Power Supply RP-11 for radio stations RS-11 series. The power transformers described in the previous Progress Report were submitted to 15 companies, two of whom expressed a desire to construct this item. One sample was received from each of these companies; neither met the requirements specified and therefore are unusable. On the basis of this, a re-evaluation of the Power Supply requirements has been made and a new design of this unit has been completed. A proposed schematic is shown as the attached drawing 2SK-558. The major effect of this re-design was to change the rectifier circuit from bridge to full wave and to eliminate some of the filter circuits in favor of dropping resistors.

The design of the Power Transformer is based on a duty cycle of 15 minutes transmission and 30 minutes reception. 7-Input taps ranging from 70 to 270 volts, 50 to 400 cycles, will be provided. These will be brought out to separate pin plugs, so that the line cord may be inserted into the proper taps as indicated by a neon bulb in the secondary circuit. The components of the AC Power Supply will fit into the carrying case in the space provided for the spare battery. Connectors for the receiver and transmitter will be provided on the side of the case as described in the equipment proposal.

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The housing for this unit has been completed and all other parts are on order.

2. Hand Crank Generator Power Supply for Radio Station Rs-11 Series. No further work on this portion of the task has been accomplished since the previous Progress Report, pending a reply to our request for authority to sub-contract development of the generator unit.

Task 3

A prototype RS-11-C transmitter/receiver station has been built and the design is 95% finalized. All purchase parts to complete Task 3 are on order and 85% has been received. Parts to be fabricated in the plant are 55% completed. Both the transmitter and the receiver prototypes are now undergoing specification tests. These are expected to be completed within four weeks for submission to the contracting agency. A new type of ink especially adapted to Polyester materials has been received and is being evaluated on the Mylar Dial Tape in the RR-11-C Receiver. Further investigation on the subject of suitable marking inks is being pursued.

SECURITY INFORMATION
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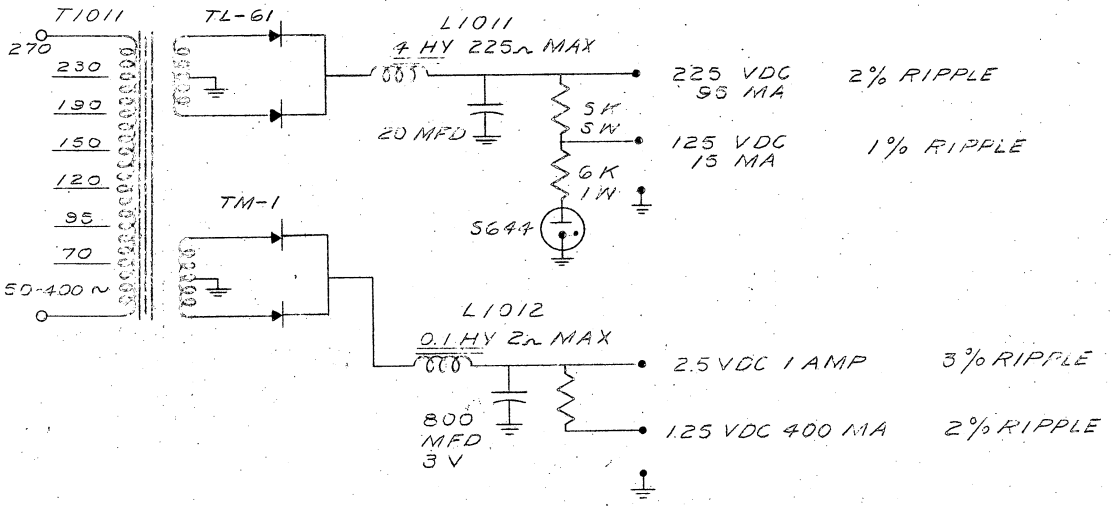
2-5K-55



BREAK ALL SHARP EDGES

REVISIONS

SCHEMATIC
FIRST USED ON 101 POWER SUPPLY

REQ'D	REF. ASS'Y	ITEM NO.

MAT'L

MAT'L REQ'D PER

FINISH

TOLERANCES UNLESS MARKED
FRAC. ± .010 DEC. ± .003
ANG. ± ½°

DWN. D.J.G. CHK. APP. DATE 1-24-57

SCALE —

2-5K-558

25X1

JOSEPH MERRITT & CO., HARTFORD, CONN. NO. 103L

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Progre port
RD85 Task 2
AC Power Supply

RD-5
Task 2
Please file

SECURITY INFORMATION
SECRET

8/17/56

The components for the filter section of the A.C. power supply have been designed and received from vendors. Calculations showing inductance and capacitance values and physical size follow on succeeding pages of this report.

The power transformer has also been designed and requests sent out to vendors. We are expecting one transformer from one vendor for test purposes in about a week. A breadboard set-up has been made to correlate calculated A.C. voltages to get required D.C. voltages out.

We have also received the silicon rectifiers that will be required for the project.

Drafting layouts for the power supply case will start upon receipt of power transformer.

The following pages include the design calculations and schematic diagrams of the A.C. power supply.

Data in Specification section of this file 25 Oct 56 WDS

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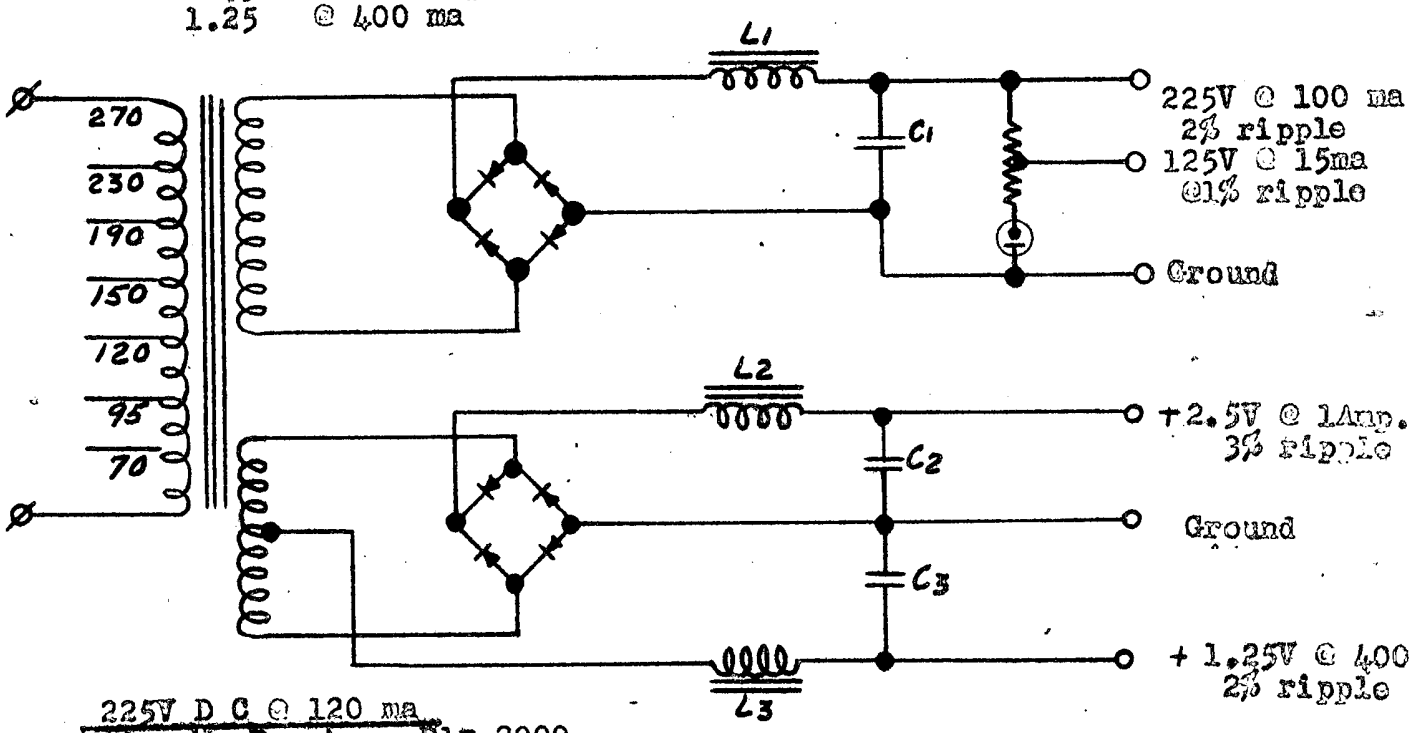
AC POWER SUPPLY FILTER SECTIONS

8/17/56
Progress Date

Input; 70, 95, 120, 150, 190, 230, 270V
50 - 400 cps.

Output of power supply;
225v @ 100 ma
125v @ 15 ma
2.5v @ 1 amp.
1.25 @ 400 ma



225V D C @ 120 ma

$L_{min} = \frac{K}{8s} R_p$ where $R_l = 2000$, $f_s = 50$ cps

$= \frac{.06}{80} \times 2000 = 2.4$ hy

for single phase full wave; ripple= .02

$\frac{.83}{LC}\left(\frac{60}{50}\right)^2 = .02$ $\qquad \frac{1.2}{LC} =$ $\qquad LC = 60$

$C = \frac{60}{2.7} = 22$Uf Let; L=4 hy then, C= 15Uf

125V @ 15 ma

$L_{min} = \frac{.06}{50} \times 8325 = 10$ hy. $\qquad \frac{1.2}{L\,0} = .01$ $\qquad LC = 120$

$\frac{.83}{LC}\left(\frac{60}{50}\right)^2 = .01$ $\qquad C = \frac{120}{10} = 12$Ufd

Eliminate

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2.5 @ 1amp
Lmin= .00375 hy

$\frac{1.2}{L\,C}$ = .03 LC= 40

$C = \frac{40}{.00375}$ = 10,700 Ufd.

Increase L to approximately .02 hy;

$C = \frac{40}{.02}$ = 2000 Ufd.

1.25V @ 400 ma
Lmin= .0037 hy.

$\frac{1.2}{L\,C}$ = .02 LC= 60

$C = \frac{60}{.0037}$ = 16,000 Ufd.

Increase L to .03 hy

$C = \frac{60}{.03}$ = 2000 Ufd.

CHOKE DESIGNS

+ 225V Section

4 hy min, 10VAC, 125ma, 100V ripple.

Core EI-21, Audio A, 29 Ga., 5/8" stack

A_e = .5 x .625 x 6.45 = 2.02 cm^2

l_{fe} = 8.26 cm

Try 3350T of #34 S.F.

Bobbin = 25/32 W.L.= 23/32 T/L= 134 x 23/32 = 96

$\frac{3350}{96}$ = 35 L

a= 1.03 [35 (.007) + .025] = .278 S.F.= 90%

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$$B_{max} = \frac{10^6 \times 10}{4.44 \times 100 \times 3350 \times 2.02 \times .9} = 370 \text{ Gauss}$$

$\phi_{mf} = 1.256 \times 3350 \times .1 = 420$

$H = \frac{420}{8.26} = 51$ Ho = 6 Uac = 350

$l_{air} = \frac{420}{14000} = .03$ cm. = .0118 in.

$V_{ac} = \frac{1}{350} = .00286$

$V_a = .00286 \quad \frac{.03}{8.26} = .0065$ $U_a = \frac{1}{.0065} = 154$

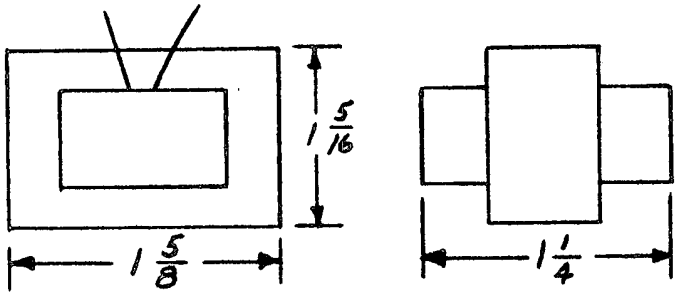
$L = \frac{1.256 \times 2.02 \times .9 \times 3350^2 \times 154 \times 10^{-8}}{8.26} = 4.7$ hy

MLT = 2(1/2 x 5/8) 6.28 (.02 .139) = $\frac{1.25}{12} \quad \frac{1}{} = .188$

L = .188 x 3350 = 627'

R 627 x .261 = 164 175

Choke drop 175 x .1 = 17.5 V.



Approximate Size

L1

125 Section

Delete

10 hy min, 5 Vac, 100 cps, 15 madc

Core EE 24-25
A = .406 cm^2
l = 5.08 cm

Bobbin - 15/32 W.L.= 13/32

Try 7250T of #41 S.F.

T/L = 286 x 13/32 = 116 $\frac{7250}{116} = 63$ L

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a = 1.03 63 (.0031) + .025 = .227 S.F. --- 91%

$Bm = \frac{10^8 \times 5}{4.44 \times 100 \times 7250 \times .406 \times .9}$ = 425 Gauss

mmf = 1.256 x 7250 x .015 = 136

$H = \frac{136}{5.08}$ = 27 Ho = 3.8 Uac = 540

$lair = \frac{136}{14000}$ = .00974 cm. = .00384 in.

$Vac = \frac{1}{540}$ = .00185

$Va = .00185 + \frac{.00974}{5.08}$ = .0038

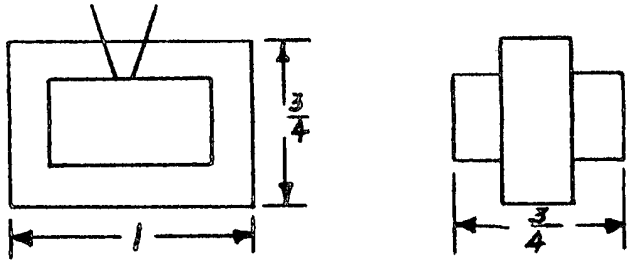
$Ua = \frac{1}{.0038}$ = 263

$L = \frac{1.256 \times .406 \times .9 \times 7250^2 \times 263 \times 10^{-8}}{5.08}$ = 12.5 hy

MLT = $2(\frac{1}{8} + \frac{1}{8}) + 6.28\ (.02 + .113) = \frac{H.835}{12}$ = .153

L = .153 x 7250 = 1110' R = 1110 x 1.32 = 1463 Ω ~ 1610

Choke drop = 24V



Approximate Size

L2

2.5V @ 1 amp.

.02 hy min, 1 amp dc, 100 cps, .1 Vac

Wire # 24 S.F. = 320 turns

Core; EI - 375, Audio "A", 29 Ga., 7/16 " Stack

Bobbin length 23/32, W.L. = 21/32

T/L = 42 x 21/32 = 27 $\frac{320}{27}$ = 12L

a = 1.03 [12 (.0213) + .025] = .288 S.F. 92%

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$A = .375 \times .437 \times 6.45 = 1.06 \text{ cm}^2$

lfc 7.3 cm $\quad Bm = \dfrac{10^8 \times .1}{4.44 \times 100 \times 320 \times 1.06 \times .9} = 74$ Gauss

mmf $= 1.256 \times 320 \times 1 = 400$

$H = \dfrac{400}{7.3} = 55 \qquad Ho = 6 \qquad Uac = 300 \qquad Vac = \dfrac{1}{300} = .00333$

$lair = \dfrac{400}{14000} = .0286 = .0113$ in.

$Va = .00331 + \dfrac{.0286}{7.3} = .00725$

$Ua = \dfrac{1}{.00725} = 138$

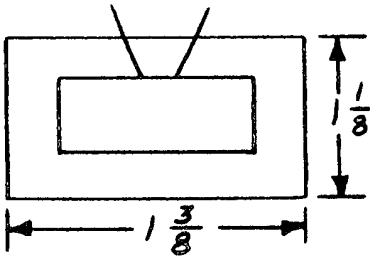
$L = \dfrac{1.256 \times 1.06 \times .9 \times 320^2 \times 138 \times 10^{-8}}{7.3} = .023$ hy

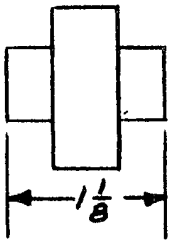
MLT $= 2(3/8 + 7/16)\ 6.28\ (.02+.144) = \dfrac{1.625+1.03}{12} = .22$

$L = .22 \times 320 = 70.5'$

$R = 70.5 \times .0256 = 1.81\ \Omega$

Choke drop $= 1.81$ V





Approximate Size

L2

1.25 @ 400 ma

.03 hy min, 400 madc, 100 cps, .03 V A C

Wire size #27SF 310T

Core EE 24-25, Audio "A", 29 Ga, $\frac{1}{2}$" Stack.

Bobbin - 15/32 W. L. = 13/32

$T/L = 60 \times 13/32 = 24 \qquad \dfrac{310}{24} = 13L$

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$a = 1.03 \left[13\ (.0152) + .025\right] = .23$ S.F. = 92%

$A = .25 \times .5 \times 6.45 = .805\ cm^2$

lfe = 5.08 cm

$$Bm = \frac{108 \times .03}{4.44 \times 100 \times 310 \times .805 \times .9} = 30$$

mmf = $1.256 \times 310 \times .4 = 156$

$H = \frac{156}{5.08} = 30.6$ Ho = 4 Uao = 350 Vac = $\frac{1}{350} = .00286$

lair = $\frac{156}{14000} = .011$ cm = .00438 in.

VA = $.00286 + \frac{.0111}{5.08} = .00504$ Ua = $\frac{1}{.00504} = 199$

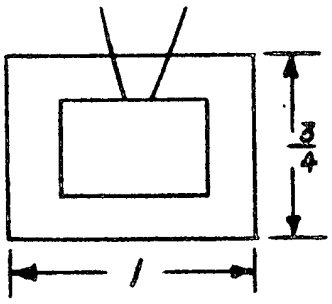
$$L = \frac{1.256 \times .805 \times .9 \times 310^2 \times 199 \times 10^{-8}}{5.08} = 1.0343 \text{ hy}$$

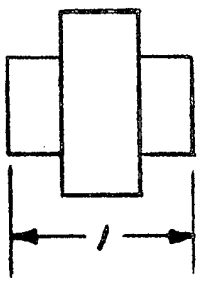
MLT = $2(\frac{1}{4} + \frac{1}{2}) + 6.28\ (.02 + .115) = \frac{1.5 + .847}{12} = .195$

L = $.195 \times 310 = 60.6'$

R = $60.6 \times .0514 = 3.12\ \Omega$

Choke drop = 1.25 V





Approximate Size

L3

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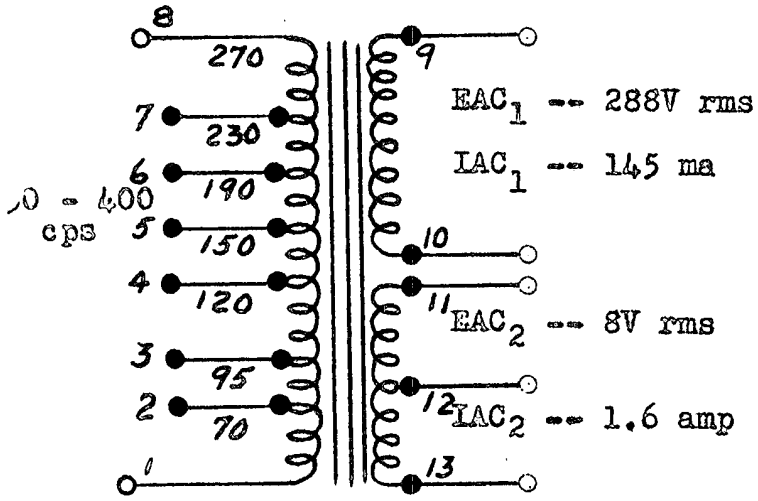
TRANSFORMER CALCULATIONS

Input; 70-95-120-150-190-230-270

50-400 cps.

Output; +225VDC @ 100 ma
125VDC @ 15 ma
2.5VDC @ 1 amp.
1.25VDC @ 400 ma

Assume; 3V. drop in rectifiers. 17.5V drop in choke.



Assume; 3V drop in rectifiers. 1.81V drop in choke.

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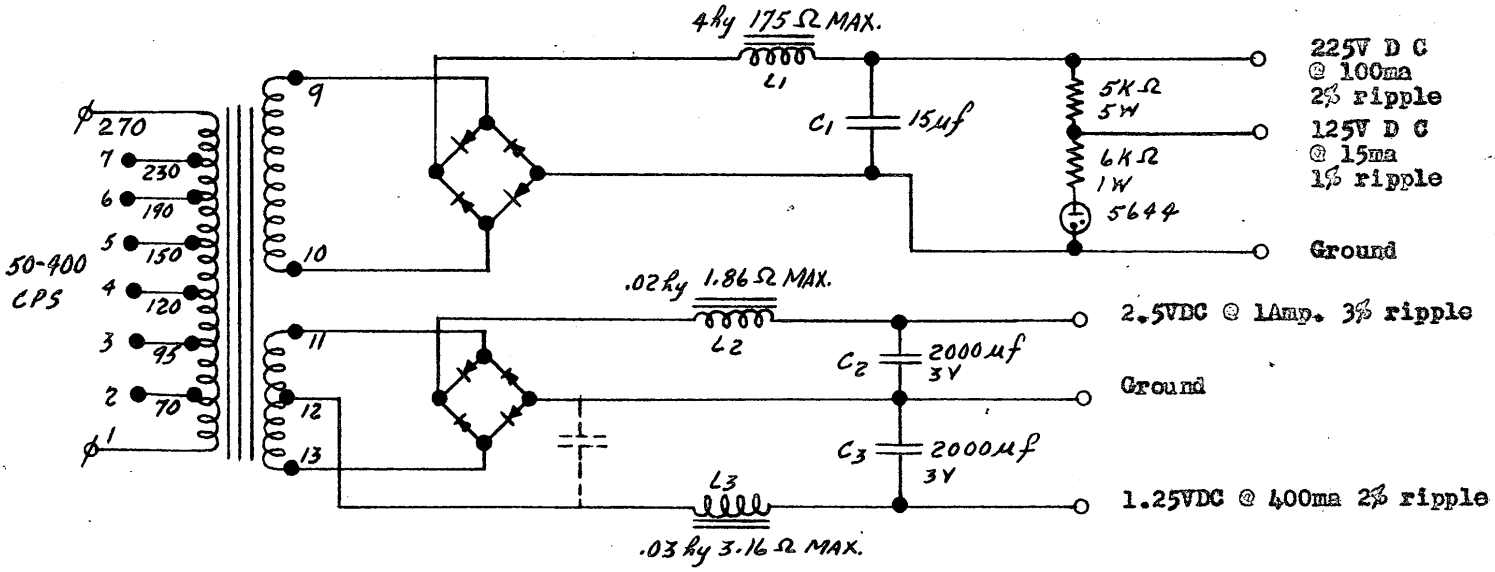
PROJECTS 88 and 101

AC power supply schematic diagram



* Silicon Rectifiers, Transitron Type TL-61 or eq.
** Silicon Rectifiers, Transitron Type TL-1 or eq.

Notes: a. The 1.25 V section may require capacitor input for voltage step-up.

b. Provision should be made for regulation of the 1.25 V receiver filament voltage.

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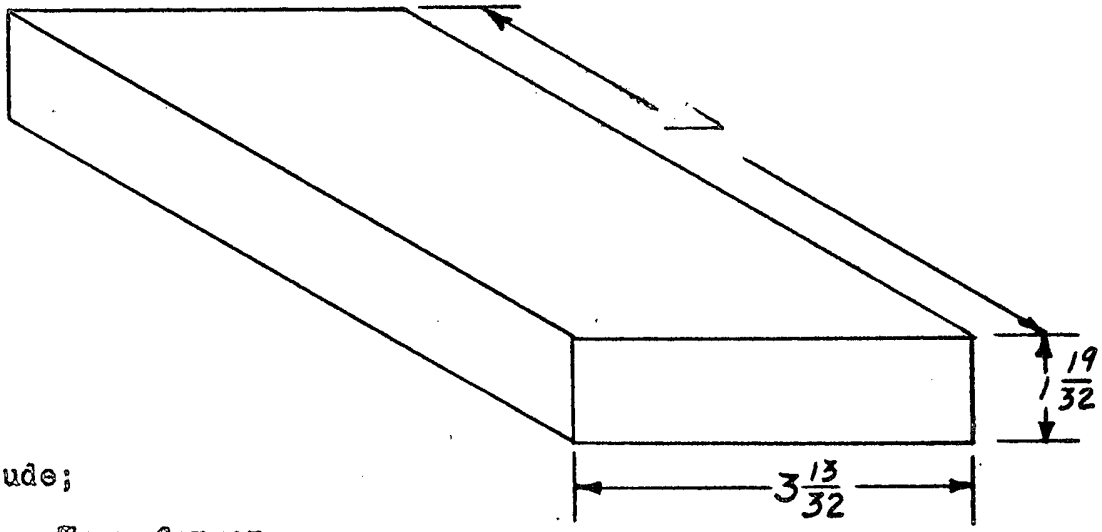
SPACE AVAILABLE FOR AC SUPPLY



to include;

1. Power Transformer
2. 3- Chokes L_1, L_2, L_3
3. 3-Capacitors C_1, C_2, C_3
4. 4-Silicon rectifiers Transitron Type TL-61.
5. 4-Silicon rectifiers Transitron Type TM-1
6. 1-Subminiature regulator tube for 125V section. (5644)
7. Tap-selecting switch.
8. Neon indicating lamp.
9. 1-Power resistor - 5K 5W.
10. 1-Power resistor - 6K 1W.

All of the above components will fit into the space shown.

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Similar calculations as were performed on the A.C. power supply filter section were also done on the hand crank generator filter section. The resultant values are shown on schematic 2-SK-515. These filtor chokes ~~capacitors~~ and tantalytic capacitors have been received from vendors.

A prepared layout of the alternator appears on drawing 2-SK-518. It appears from inquiries that have been sent out that the 1.265 inch length of the alternator (necessary for the alternator to fit into the carrying case that has been designed for the receivers and transmitters) is quite difficult to meet. A question will be raised at this point. Is it absolutely necessary that the hand crank generator fit into the carrying case? The vendors have also been informed that the overall diameter of the alternator could go larger but that still doesn't appear to help the length situation. Eastern Air Devices in Dover, New Hampshire has prepared an alternator with a diameter of 3-5/16 inches by 3 inches in length. Induction Motors Company has also prepared approximately the same dimensions. Your comments on this matter would be greatly appreciated.

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[illegible] 11/00-0 DATA [illegible] INFORMATION & TECHNICAL CHARACTERISTICS

25X1

Type of Unit: ☐ Open ☐ Enclosed ☐ Non-cooled ☐ Self-cooled
☐ D.C. Tach Gen. ☐ A.C. Tach Gen. ☑ Single Phase Alt. ☐ 2 Phase Alt.
☐ 3 Phase Alt. ☐ Multiple Frequency (Indicate Combination)

Nominal Output Volts/RPM & Allowable Tolerance — Output Linearity

Speed Range: Max. — Min. — Variation in Volts Out — C.W. — C.CW.

Speed(s) 4000 RPM - NOMINAL

Frequency(s) 400 CYCLES/SEC.

Voltage(s) 225 VDC @ 100 MA - 125 VDC @ 15 MA - 2.5 VDC @ 1 AMP - 1.25 VDC @ 400 MA

Amperage(s) (SEE SCHEMATIC & LETTER)

Wattage(s)

Phase Data

Power Factor of Load(s) SEE SCHEMATIC - ½ & FULL WAVE RECTIFIER SYSTEMS

% Max. Harmonic Distortion Permitted ~

Temp. Ambient (°C.) 20°C Low -40°C +40°C High

Duty Cycle: ☑ Intermittent Time On 12 DUTY CYCLES PER SEC Time Off ☐ Continuous (How Long?)

Special Noise Requirements:

Rotation: ☑ Reversible ☐ Clockwise ☐ Counterclockwise (Viewed from load end)

Max. Dimensions (except shaft): Dia. 3½" Length 1.265" INCLUDING PINION

Connections: ☐ Terminals Type ☑ Leads No. 22 AWG Length 6" Type

Shaft Data: ☑ One End Dia. Ext. (Indicate flat, slot, etc., if applicable)
☐ Second End Dia. Ext. " " " " " "
☐ Splined Data: ☐ Threaded Data:

Bearings: ☐ Sleeve ☑ Ball Class ABEC 5 Type OPTIONAL

Lubrication: ☐ Standard ☑ Special (Specify Type)

Life Expectancy: 1000 HRS OPERATING LIFE - INDEFINITE SHELF LIFE

Mounting: ☐ Flange ☑ Synchro Ring SEE SKETCH ☐ Other (Specify Type)

Weight: (Lbs. & Oz.) 3 LBS MAX

% Regulation: Speed % at load Voltage 2 % at FULL load. @ 4000 RPM

Application: ☐ Commercial ☑ Military ☐ Applicable Specs.

Nature of Application: HAND CRANK GENERATOR - SUBMINIATURE

Other Requirements:

No. of Prototypes Required ONE Date Required: 3 MO. FROM DATE OF P.O.

Production Quantity Required TEN Date Required: 7 MO. FROM DATE OF P.O.

Approx. Price Ranges: Prototypes $2500 Production Quantities $75.00

Use reverse side for color code, diagrams, and other comments.

NOTE TO SALES: Indicate (on reverse side if necessary) nearest existing type to customer's requirements, with desired differ-

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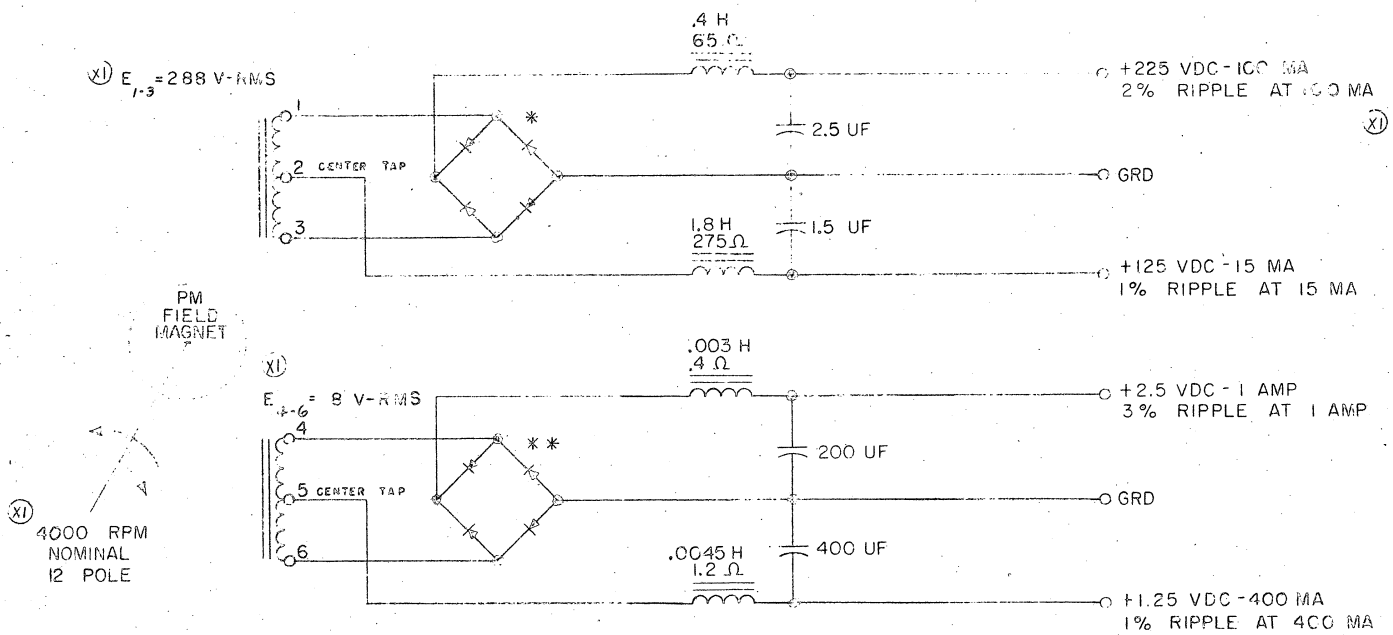
2-SK-515



* 4 BOGUE ELECTRIC TYPE ISJ50 SILICON RECTIFIERS OR EQUAL
** 4 TRANSITRON TYPE TMI SILICON RECTIFIERS OR EQUAL

BREAK ALL SHARP EDGES

REVISIONS
(XI) 4000 RPM W.S. 4500 100 MA MIN. 5-17-56 EFB

SCHEMATIC DIAGRAM - HAND CRANK GENERATOR
FIRST USED ON 101
REQ'D | REF. ASS'Y | ITEM NO. 25X1
MAT'L
MAT'L REQ'D PER
FINISH
DWN. O H K | CHK. | APP. C 7 | DATE 5-27-56
TOLERANCES UNLESS MARKED
FRAC. ± .010 DEC. ± .003
ANG. ± ½°
SCALE
2-SK-515

JOSEPH HERGITT & CO., HARTFORD, CONN. NO. 105L

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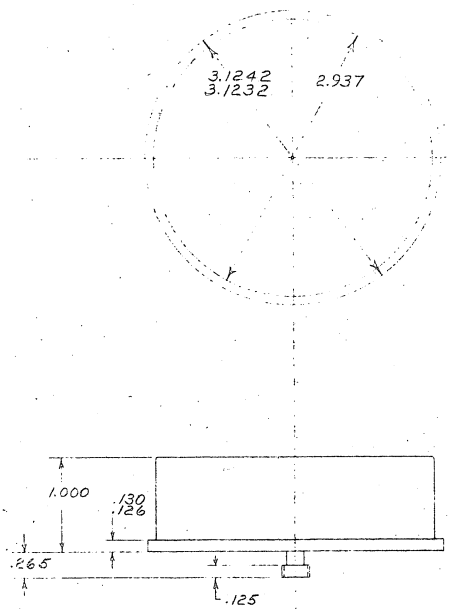
SK-518



GENERATOR :-A.C.
MAX. WEIGHT - 3LB.
SHAFT DIA - 3/16

PINION:
20° PRESSURE ANGLE
12 TEETH
48 PITCH
.250 PITCH DIA

BREAK ALL SHARP EDGES

REVISIONS

GENERATOR- A.C. (HAND-CRANK)

FIRST USED ON PROJ 151				25X1 NO.
MAT'L				
MAT'L REQ'D PER				
FINISH	DWN. JFB	CHK.	APP.	DATE 4-20-56
TOLERANCES UNLESS MARKED FRAC. ± .010 DEC. ± .003 ANG. ± ½°	SCALE 1/1	2 SK-518		

JOSEPH MEREDITT & CO., HARTFORD, CONN. NO. 105L

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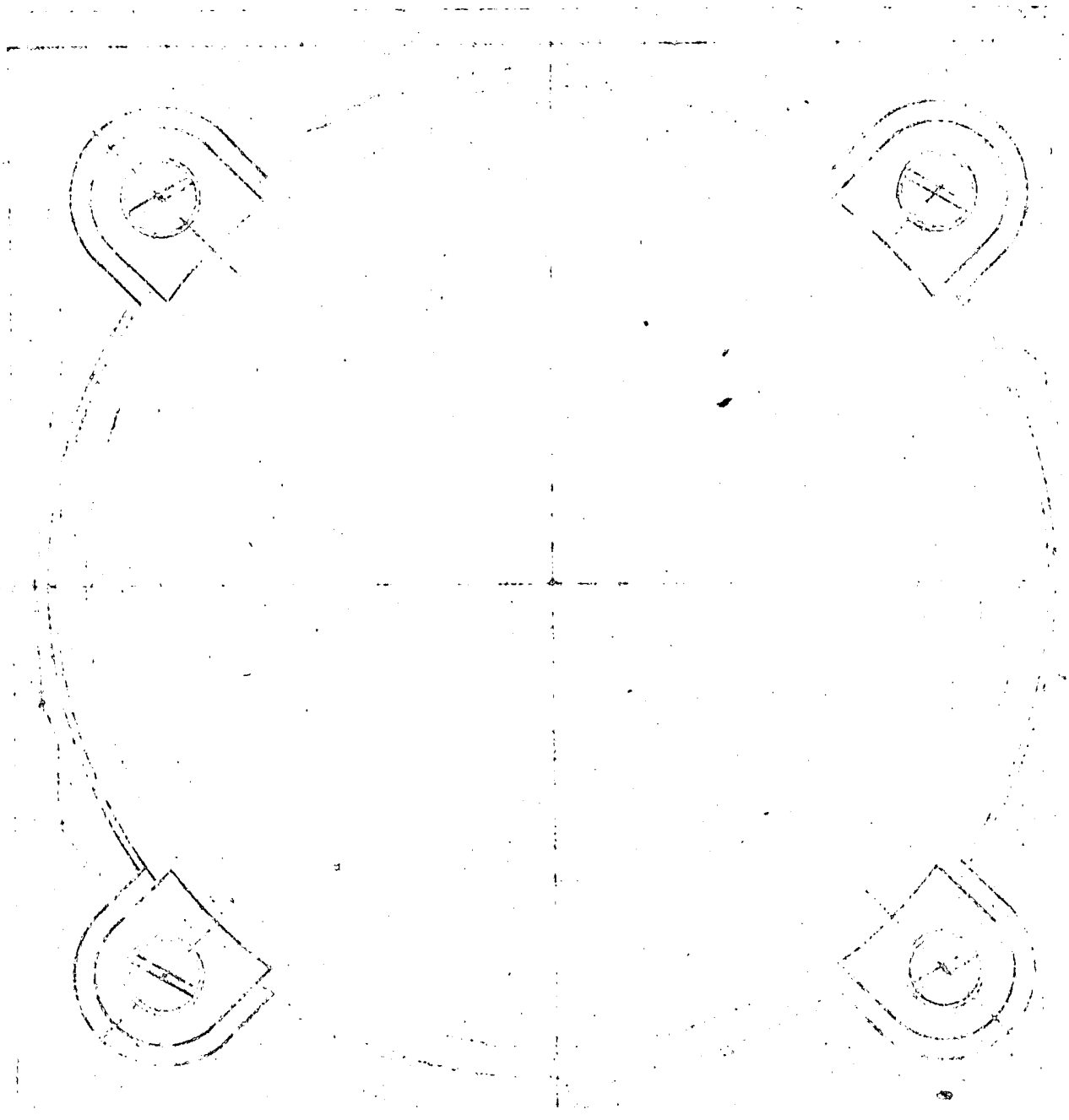

TOP VIEW - PROPOSED METHOD OF MOUNTING

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EQUIPMENT PROPOSAL

Auxiliary Power Supply Units For RS-11A and RS-11B Equipment

To provide maximum utility for the RS-11A and RS-11B, it is desirable to have power supply units available to permit operation from other sources than the self-contained battery pack. Three power supply units are considered and described in this proposal. These are 1) an AC Power Supply, 2) a hand-cranked generator and 3) a gasoline engine generator.

In each case, equipment weight is to be kept at an absolute minimum to insure good portability. At the same time, the design must take into account the great importance of reliability and in no case has any sacrifice been made in this direction.

The Power requirements of the RS-11A/B equipment have been determined to be 0.96 watts during receiving and 20.7 watts during transmitting. We have planned these auxiliary power supply units so that they will provide excellent operation of the RS-11A/B equipment. The three tubes used in the transmitter are of the filamentary type; no standby power need be expended in the transmitter during periods of reception.

A.C. Power Supply

The RP-11 power supply has been planned to fit easily within the carrying case designed to hold the RS-11A/B equipment. An outline drawing is shown in Fig. 1. The proposed dimensions are 3-13/32 x 1-19/32 x 7". This power supply can be carried in the regular equipment carrying case, CC-11, in place

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of a spare battery as shown in Fig. 2.

We have planned to eliminate all interconnecting cables in the RS-11 system. This feature will be applied to the AC power supply also. As shown in Fig. 1, the transmitter and receiver will plug directly onto the power supply unit.

The receiver normally requires a filament supply of 1.25 volts at 140 milliamperes and a plate supply of 135 volts at 6 milliamperes. When loaded to its normal power output, the transmitter requires a filament supply of 2.5 volts at 1.06 amperes and a plate supply of 225 volts at 80 milliamperes. The RP-11 will supply proper voltages for both of these operating conditions. The receiver plate voltage will be regulated by a gas-discharge regulator tube. This will insure optimum performance through wide variations in supply line voltage.

The input to the AC power supply will have a tap switch to permit operation from 70 to 270 volt AC mains. Components will be designed for operation on any AC mains frequency from 50 to 400 cycles per second. Filtering will be included to remove all objectionable ripple from both the filament and plate supply voltages.

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for RS-11A/B Equipment

We propose to use Hypersil cores in the power transformer and filter choke in order to achieve minimum weight for the power level required. We also propose to investigate the use of germanium rectifiers and tantalytic filter capacitors. We feel that the weight of the completed unit, including filter, will not exceed 5½ lbs.

Hand-Cranked Generator

In the design of a hand-cranked generator for operating the RS-11A/B equipment, it is important that we make most efficient use of the energy that is being expended. Since there is such a large difference between the power required during receiving and during transmitting, both the circuit configuration and mechanical arrangement must allow this to be reflected back to the prime mover. Thus, it should require a very small amount of effort on the part of the operator or his assistant to run the unit during receiving periods.

It is important, too, that this unit be constructed so that it can be dis-assembled merely by folding a few extended parts toward the main body of the unit and slipped into a very compact carrying case.

With presently proposed designs, we feel that in the folded condition, this equipment may not require much more volume than the RS-11A/B equipment and be packed in a similar case.

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The hand-cranked generator unit will contain some form of regulation to insure constant output with varying speeds as long as the speed exceeds some minimum level. This will probably take the form of a centrifugal switch mounted on the generator shaft which reduces the field current of the generator when the minimum speed has been reached.

The unit will contain built-in filter equipment to remove commutating hash from the filament and plate circuits. It is also important that this filter be mounted directly on the generator unit in order that it should be effective in reducing radiated electrical hash from the leads and equipment.

The hand-cranked generator unit will provide the operating voltages listed previously to provide proper operation during both transmitting and receiving periods. The plate supply voltage for the receiver will be regulated by a gas-discharge regulator tube to insure optimum performance under all operating conditions.

During this development program, work will be conducted to study the relative merits of foot-crank versus hand-crank operation. It is obvious that the big muscles of the legs are more capable of providing work output for sustained periods than the arms. It remains to find an acceptable design of the generator unit which can make good use of this leg power. It is possible that such a unit would be smaller

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in size than a hand-cranked unit due to the lack of need for the supporting structure.

Gasoline-Engine Generator

Through a cooperative arrangement with the Special Purpose Engine Co., of New York, we have designed a gasoline-engine generator using their smallest, high reliability engine. This engine has been designed around some earlier British Equipment and for the output we require, weighs less than 10 lbs. It has been tested, during the past three years, by the Air Corps and been found to be easy starting and highly dependable.

We plan to use with this engine the same generator unit described above for the hand-cranked equipment. The generator will include voltage regulation facility which will insure constant output voltage under any speed variation that may be encountered.

The engine unit is fitted with a muffler-silencer which makes its operation extremely quiet. It will be fitted with a shielded ignition system to eliminate any radiated electrical noise. The generator, too, will be fitted with an appropriate filter to remove all traces of commutator hash from the leads.

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We propose to package this entire gasoline-engine generator in a case no larger than 6" x 10" x 12" and its outer surface can be made to look much like a suitcase. It is estimated that the weight of the complete equipment will be less than fifteen pounds.

It is our feeling that this engine-driven power supply will be the most convenient means of operating the RS-11A/B equipment.

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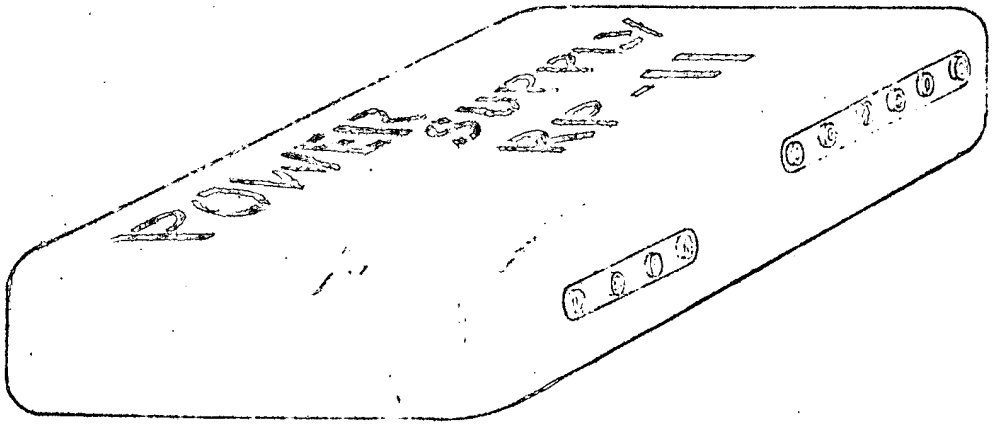

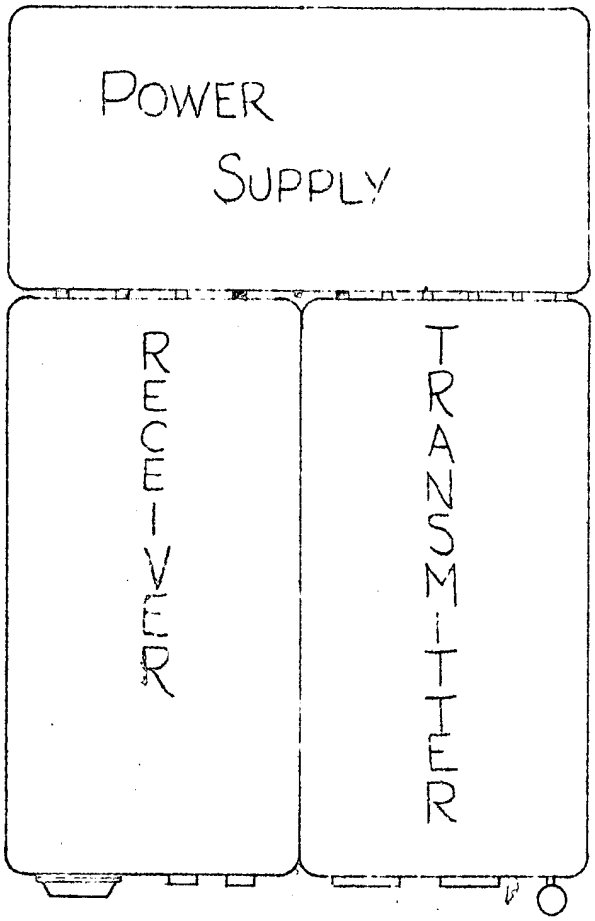

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FIG. 1.

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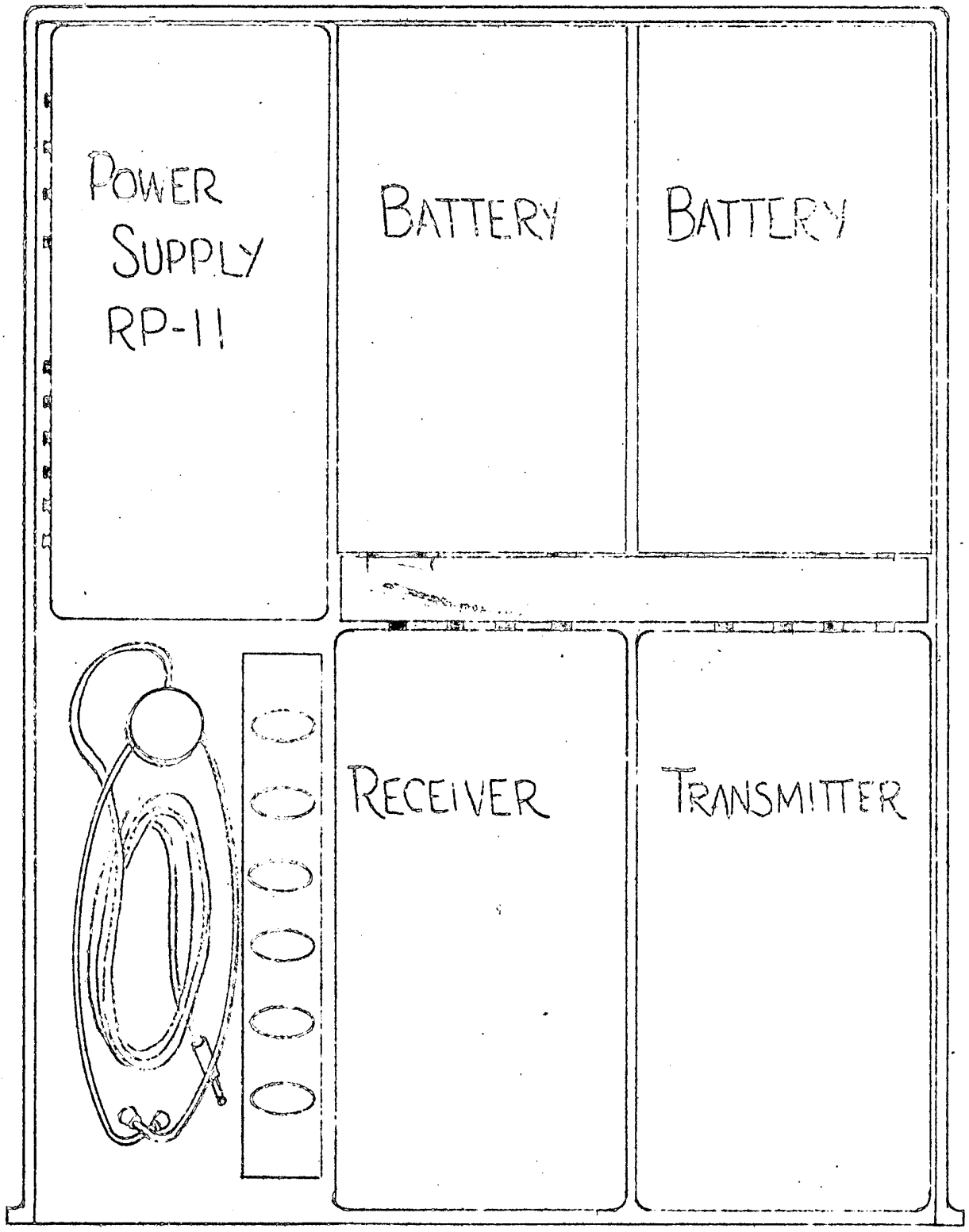

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FIG. 2

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